Effects of Slatted Flooring on Claw Shape in Intensively Housed Fattening Beef Cattle

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Introduction

Intensivism in the Irish beef industry is a recent and fast-developing process involving the concentration of cattle into large slatted floor houses where they are confined for a six-month winter period. Surveys carried out to assess any alterations in the disease pattern as a result of changing to slatted floors from traditional straw yard housing indicated that twice as much disease (10% incidence) was encountered on slatted floors as on straw yard (5% of cattle).

Lameness with an incidence of five *percent* of cattle affected was the most serious disease problem on slats and the major lesion causing lameness was septic traumatic pododermatitis which accounted for 43 *percent* of all lameness cases. Surveys of defects of claws *post-mortem* indicated that abrasion of the white line was the primary inciting cause of bruising and penetration at the white line though ungulysis or chronic foot rot was an important secondary cause.

Abrasion of hoof horn was considered a function of two factors—floor construction and horn quality. Accordingly to assess the influence of floor construction on claw shape through abrasion the rates of horn growth and wear were measured in beef cattle housed either on slats or on straw over a six-month winter period.

Materials and Methods

Growth and wear rates of hoof horn were measured in ten Friesian and ten Hereford bullocks equal numbers of which were divided randomly but by bodyweight between housing on slats and on straw. The groups had similar mean bodyweight (380 kg) and measurements of solar surface area showed a mean solar pressure of 1 kg/cm^2 for each group. The cattle were fed medium-quality silage *ad lib* with 3.20 kg of rolled barley and 0.45 kg of soya bean meal per head per day and were unaffected by disease throughout the six-month experimental period.

Horn growth was recorded by measuring the migration of a kerf mark from a permanent tattoo reference point above the coronet and horn wear by measuring the migration of the kerf mark towards the bearing surface. This method has been described previously in dairy cows (Prentice 1970). Measurements were made abaxially on the lateral and medial claws of a fore and hind foot in each animal at monthly intervals over a six-month (168 days) period. Within each claw, measurements were made at three locations in the wall horn—the toe, the mid-wall and the heel regions. All measurements were taken twice using a dial calipers graduated to 0.05mm and kerf marks were replaced before they grew out of the distal wall surface.

Results

Because of the many locations of measurement and the analysis of the influence and interaction of housing, breed, front or hind and lateral of medial claw etc. and the results of this experimental and their statistical analysis are complex. They are not reported in full but have been described in detail elsewhere (Murphy 1979). The mean daily-rates of horn growth and wear are shown in Table 1 for comparison purposes.

In summary, however, significantly increased horn growth was recorded on slatted floors compared with straw yards only in the front medial ($P<.001$) and hind lateral ($P<.01$) claws (Figure 1). As these are the major weight-bearing claws in the bovine they may have grown faster in response to this stress. The heel of both front claws grew faster ($P<.05$) on slats. Horn abrasion on the other hand,

TABLE 1. Mean Daily Horn Growth and Wear Rates (mm/day) at the Toe, Middle and Heel locations in the Claws of Cattle on Slats and on Straw.

		Slatted		Straw	
		Growth	Wear	Growth	Wear
Front	Toe	0.176	0.147	0.164	0.095
Lateral	Middle	0.218	0.166	0.205	0.126
	Heel	0.254	0.179	0.234	0.152
Front	Toe	0.200	0.156	0.176	0.103
Medial	Middle	0.263	0.199	0.231	0.147
	Heel	0.294	0.220	0.247	0.186
Hind	Toe	0.204	0.180	0.184	0.136
Lateral	Middle	0.230	0.184	0.209	0.161
	Heel	0.244	0.187	0.221	0.177
Hind	Toe	0.215	0.176	0.192	0.141
Medial	Middle	0.236	0.191	0.221	0.157
	Heel	0.242	0.208	0.227	0.171

FIGURE 1

AREAS OF INCREASED HORN GROWTH ▦, INCREASED HORN WEAR ▩ AND BOTH ▭ IN CLAWS ON SLATS RELATIVE TO THOSE ON STRAW

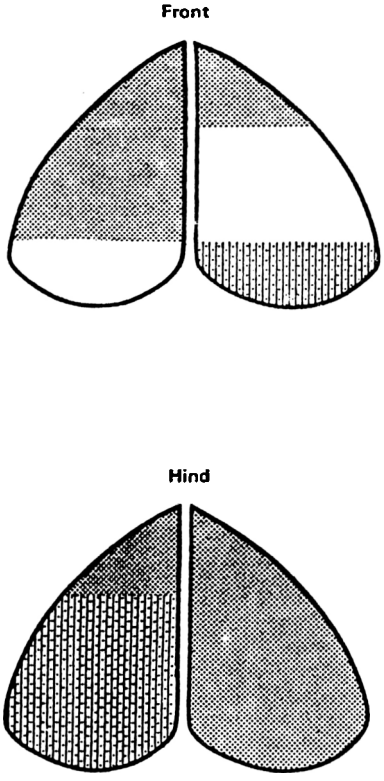
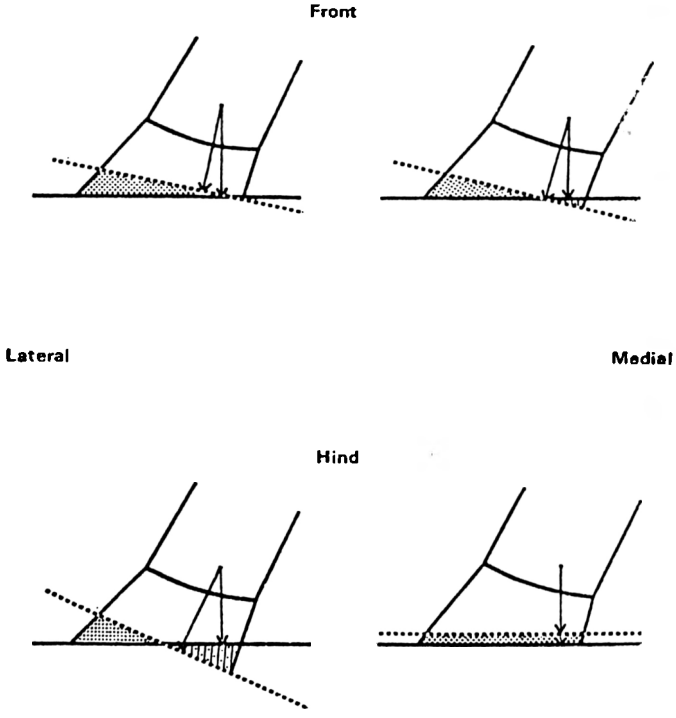


FIGURE 2

ALTERATIONS IN CLAW SHAPE IN CATTLE ON SLATS RELATIVE TO CLAWS ON STRAW

INCREASED HORN GROWTH ▦
INCREASED HORN WEAR ▩



was increased at all locations ($P<.01$) on slats compared with straw except notably at the middle and heel locations in the toe area (($P<.001$) of all claws on slats.

These changes resulted in a net loss of horn at all locations on slats compared with straw except to a slight extent at the heel of the front medial claw and more importantly at the heel in the hind lateral claw. Both front claws suffered a net loss of horn anteriorly at the toe and middle locations (Figure 2) but not at the heel which grew higher in the medial claw. In the hind limb each claw behaved differently. The hind media claw suffered a net loss of horn at all locations. On the other hand, the hind lateral claw showed net loss of horn at the toe, no change at the middle and net gain at the heel due to slatted housing.

Both horn growth ($P<.001$) and horn wear ($P<.01$) were significantly increased in all claws of Friesian cattle compared with Herefords. These changes were leased in the hind medial claw ($P<.05$) but were strongly evident in the hind lateral claw ($P<.001$).

Discussion

It is concluded on the basis of these results that, on housing on slatted floors, both front claws tilt forward due to toe abrasion. This raises the heels off the ground and results in greater heel horn growth even anteriorly to cover the sole with consequent movement of the centre of weight-bearing anteriorly within the hoof. In the hind limb, the medial claw shows no change in shape or a slight backward tilt due to slatted flooring. While both claws in the front limb behave similarly, the weight-bearing hind lateral claw behaves in an opposite manner to the hind medial. It alters in the same way as the front claws with toe abrasion, forward tilting of the claw, reduced heel abrasion and increased heel growth over the sole. This difference between claws is accomodated by lateral rotation of the hind digits to assume a cow-hocked position a condition easily observed in cattle housed for some time on slats.

In studies in dairy cows, Toussaint Raven (1973) has shown that cow-hocked conformation is associated with increased weightbearing in the hind lateral claw. In beef cattle on slats it is suggested that this factor is also at work and that, in addition, this extra weight on the hind lateral claw is being born through a point more anterior than normal. Increased weight is borne on the sole-heel junction rather than heel

area. It has been stated (Greenough et al., 1972) that the increased concussion in this claw cannot be absorbed anterior to the digital cushion so lateral expansion of the hoof causes separation of the white line. This separation and subsequent penetration is accelerated where horn quality is poor as with ungulysis or where poorly designed slatted floors cause increased abrasion of the white line. Since horn growth and horn wear were increased in cattle of the Friesian breed compared with Herefords, it is suggested that a faster turnover of horn occurred in Friesian cattle due to a softer horn texture and that this accelerated the development of cow-hocked conformation in the Friesian breed. Thus Friesians were exposed to higher levels of abrasion and penetration of the white line on slats, predisposing them to higher levels of septic traumatic pododermatitis as noted in the clinical surveys.

Changes in the hind lateral claw occurred especially in the first month of the season and again at the fifth month, which times correspond closely with times of peak incidence of clinical lameness in cattle on slats.

In summary therefore, it is suggested that the primary inciting cause of septic traumatic pododermatitis in beef cattle is increased abrasion on slatted floors. The extent of this abrasion is governed by housing factors such as floor environment and slat design and by animal factors including breed, behavioural characteristics; physiological composition of hoof horn particularly anatomical and pathological changes in claw shape. The results confirm that it is the interaction of these factors which causes the high incidence of foot disease in beef cattle fattened on slatted floors in Ireland.

References

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Abstracts

Use of an oxfendazole pulse release bolus in the control of parasitic gastroenteritis and parasitic bronchitis in first-season grazing calves

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The efficacy of the oxfendazole pulse release bolus system for the control of parasitic gastroenteritis and parasitic bronchitis in first-season grazing calves was evaluated in Belgium. Twenty-two calves were allocated to two groups. The calves in one group received a bolus at the time of turn out, while the other group remained untreated. The efficacy of the bolus was assessed by comparison of faecal worm egg counts, plasma pepsinogen concentrations, the antibody response to *Ostertagia, Cooperia* and *Dictyocaulus* species total plasma protein and albumin concentrations, and weight gains throughout the grazing season and the housing period. The oxfendazole pulse release bolus provided good control of parasitic gastroenteritis dominated by ostertagia. The effects of parasitic gastritis were greatly reduced as shown by the significantly lower values of serum pepsinogen and ostertagia antibody titres. The use of the bolus further reduced the adverse effects of parasitism as indicated by better liveweight gains and normal total plasma protein and albumin concentrations whereas in the untreated control group hypoproteinaemia and hypoalbuminaemia were observed. Most animals exhibited clinical signs of parasitic bronchitis at the end of the grazing season, and the bolus may not adequately control parasitic bronchitis in all cases at all times.

Epidemiology of *Salmonella typhimurium* infection in calves: Excretion of *S typhimurium* in the faeces of calves in different management systems

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Twenty-five batches of market-purchased calves, comprising 589 animals on 11 farms, were examined for the excretion of salmonellas for at least 28 days after their arrival. Salmonellas were found in 217 (51 per cent) of 423 calves from 18 of 21 batches on nine farms. The calves were housed in single pens on eight farms and in groups on the others. The trends in new excreters and the proportion of *Salmonella typhimurium* excreters were similar in both types of housing, a peak of excretion which was slightly higher in single penned calves, being reached 18 to 19 days after arrival. New excreters were found at most samplings in both types of housing, but the peak of new excreters appeared earlier and declined sooner in single penned calves. On average, single penned animals excreted salmonellas longer. *Salmonella dublin* was found only in single-penned calves, and the trend in excretion was similar to that for *S typhimurium* in single-penned calves except that the peak was at about 28 days. Prophylactic feeding of antibiotics was practised on nine farms, but appeared to have no influence on the excretion of salmonellas. Salmonellas were isolated from the environment in six of nine farms studied, even after cleaning and disinfection. It is suggested that the persistence of salmonellas in the environment deserves more attention in the formulation of control programmes.